



MAR 11 2005

RESULTS OF TOXICITY TESTING
WITH *Leptocheirus pumulosus* ON 15 DECEMBER 2005
SEDIMENT SAMPLES FROM THE DELAWARE RIVER

Prepared for:

Department of Natural Resources and Environmental Control
Division of Air and Waste Management
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Results relate only to the items tested or to the samples as received by the laboratory.

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This report contains 10 pages plus 2 attachments.

Wayne L. McCulloch
Laboratory Director

4 March 2005

Date

1. INTRODUCTION

At the request of the State of Delaware Department of Natural Resources and Environmental Control (DNREC), EA Engineering, Science, and Technology performed 10-day solid phase survival toxicity tests with the amphipod *Leptocheirus plumulosus*. The purpose of this study was to evaluate the toxicity of three sediment samples collected from the Delaware River following an oil spill upstream. These three samples were collected on 15 December 2004, 16 days after sediment samples were collected to establish baseline toxicity profiles. The results of the *L. plumulosus* sediment toxicity testing performed on the 29 November 2004 baseline sediment samples is presented in EA Report #4677.

2. MATERIALS AND METHODS

2.1 SAMPLE RECEIPT AND PREPARATION

Three sediment samples were collected by DNREC personnel on 15 December 2004 and transported on ice to EA's Ecotoxicology Laboratory in Sparks, Maryland. Upon receipt at EA on 22 December 2004, the sediment samples were logged in and assigned EA laboratory accession numbers, and were stored in the dark in a secured walk-in cooler at $\leq 4^{\circ}\text{C}$ until used for testing. Prior to use in testing, each sediment was homogenized, and large rocks and debris were manually removed and discarded from the sample. Table 1 summarizes the sample identifications, accession numbers, and collection and receipt information for the sediment samples. Chain-of-custody records are included in Attachment I.

2.2 CONTROL SEDIMENT

A sample of sediment from Codorus Creek, Pennsylvania, was used as the control sediment for the toxicity testing. The sediment was collected in an area designated as a state wild trout stream. Sediment collected from this location has historically been non-toxic and is routinely utilized as a control in EA's sediment toxicity tests.

2.3 OVERLYING WATER

Artificial sea water (Forty Fathoms sea salts) at 5 ppt salinity was used as the overlying water. Dechlorinated tap water was used to prepare the artificial sea water. The source of the tap water was the City of Baltimore municipal water system. Upon entering the laboratory, the water was passed through a high-capacity, activated-carbon filtration system to remove any possible contaminants such as chlorine, detergents, and other possible trace organic contaminants. This water source has proven safe for aquatic organism toxicity testing at EA as evidenced by maintenance of multigeneration *Daphnia* sp., *H. azteca* and fathead minnow cultures with no evident loss of fecundity.

2.4 TEST ORGANISMS

Whole sediment toxicity testing was conducted with the estuarine amphipod *Leptocheirus plumulosus*. The amphipods (2-4 mm) were acquired from Aquatic BioSystems. Organism lot number LP-026 was received on 6 January 2005 and used to initiate the toxicity test on 11 January 2005. During the holding period, the organisms were gradually acclimated to laboratory water at 20°C and the appropriate test salinity of 5 ppt. The organisms were fed finely ground Tetramin flake food during the acclimation period.

2.5 TOXICITY TEST METHODS

All toxicity testing was conducted following EA's standard operating procedures (EA 2003) which are in accordance with US EPA guidance (1994).

The whole sediment toxicity tests were conducted as static, non-renewal tests with ten days of exposure to the whole sediments and overlying water. Prior to initiation of the toxicity tests, the sediments and overlying water were added to the test chambers, and the suspended sediments were allowed to settle overnight. The addition of the test organisms to the exposure chambers on the following day marked the initiation of the toxicity tests.

The *L. plumulosus* tests utilized 1-L beakers as the exposure chambers, with each beaker containing 200 ml of sediment and 700 ml of overlying water. There were five replicate chambers for each sediment sample and control. Test organisms were randomly assigned to the test chambers, 20 organisms per replicate chamber for a total of 100 organisms per sample.

The tests were maintained at 20±1°C with a 16-hour light/8-hour dark photoperiod. The test chambers were visually inspected daily for abnormal organism behavior/lack of burrowing. Water quality measurements of temperature, pH, dissolved oxygen, and salinity were recorded daily on one replicate of each sample and control. The water quality parameters measured during the toxicity tests are summarized in Table 2. The test organisms were not fed during the 10-day exposure period. After ten days of exposure, the test organisms were retrieved from the samples and the number of live organisms per replicate was recorded.

Statistical analyses were performed on the whole sediment test data according to US EPA (1994) guidance and using the ToxCalc statistical software package (Version 5.0, Tidepool Scientific Software). Statistical analyses were performed to determine if exposure to either of the sediment samples resulted in significantly lower ($p=0.05$) survival of the test organisms as compared to the control sediment. A summary of the survival data for the *L. plumulosus* exposed to each sediment sample is provided in Table 3. Copies of the original data sheets are included as Attachment I.

2.6 REFERENCE TOXICANT TESTING

In conformance with EA's quality assurance/quality control program requirements, reference toxicant testing was performed on the acquired lot of *L. plumulosus*. The reference toxicant test consisted of a graded concentration series of cadmium chloride in water only tests, with no sediment present in the test chambers. The results of the reference toxicant test was compared to established control chart limits.

2.7 ARCHIVES

Original data sheets, records, memoranda, notes, and computer printouts are archived at EA's Baltimore Office in Sparks, Maryland. These data will be retained for a period of 5 years unless a longer period of time is requested by the State of Delaware Department of Natural Resources and Environmental Control.

3. RESULTS AND DISCUSSION

The results of the *Leptocheirus plumulosus* whole sediment toxicity tests met the current NELAC standards, where applicable.

Table 3 summarizes the results of the toxicity tests conducted on the 15 December 2004 Delaware River sediment samples. There was 91 percent survival of *L. plumulosus* in sample DRSED01, and 95 percent survival in sample DRSED02, after 10 days of exposure. The 10-day survival in sediment DRSED03 was only 32 percent. The DRSED03 sample gave off an oily sheen, and had a strong petroleum smell. Survival in the control sediment was 93 percent. Statistical analysis indicated that the DRSED03 sample was the only post oil spill sediment sample that was significantly ($p=0.05$) different from the control. There was no evidence of any oil in the DRSED01 and DRSED02 test treatments.

The 48-hour LC50 for the reference toxicant test conducted on Lot LP-026 was 10.9 mg/L Cd, which was within EA's established laboratory control chart limits of 1 – 15.0 mg/L Cd, indicating that the acquired organisms were of acceptable quality.

4. REFERENCES CITED

EA. 2003. EA Ecotoxicology Laboratory Quality Assurance and Standard Operating Procedures Manual. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

US EPA. 1994. Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and marine Amphipods. EPA 600/R-94/025. U.S. Environmental Protection Agency, Office of Research and Development, Narragansett, Rhode Island.

TABLE 1 SUMMARY OF COLLECTION AND RECEIPT INFORMATION FOR 15
DECEMBER 2004 SAMPLES FROM DELAWARE RIVER

Sample Identification	EA Accession Number	Collection Time and Date	Receipt Time and Date
CONTROL	AT5-021	10 January 2005	10 January 2005
DRSED 01	AT4-800	1345, 15 December 2004	1600, 22 December 2004
DRSED 02	AT4-798	1530, 15 December 2004	1600, 22 December 2004
DRSED 03	AT4-799	1130, 15 December 2004	1600, 22 December 2004

TABLE 2 SUMMARY OF WATER QUALITY PARAMETERS FROM 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Leptocheirus plumulosus* ON DELAWARE RIVER SEDIMENTS

Test Species: <i>Leptocheirus plumulosus</i>		Water Quality Parameters – Range			
Test Number: TN-05-013					
Sample ID	EA Accession Number	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Lab Control	AT5-025	19.0-20.9	6.7-7.4	3.9-8.5	4.3-5.0
DRSED 01	AT4-800	19.0-21.0	6.7-7.6	3.6-8.6	4.3-5.0
DRSED 02	AT4-798	19.0-20.9	6.8-7.6	4.4-8.4	4.5-4.9
DRSED 03	AT4-799	19.0-20.5	6.7-7.4	3.2-8.5	4.4-5.0

TABLE 3 RESULTS OF 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH
Leptocheirus plumulosus ON DELAWARE RIVER SEDIMENTS

Test Species: *Leptocheirus plumulosus*
 Test Number: TN-05-013
 Sample Date: 15 December 2004
 Test Date: 11-21 January 2005

<u>Test Treatment</u>	<u>10-Day % Survival</u>
LAB CONTROL	93
DRSED 01	91
DRSED 02	95
DRSED 03	32 ^(a)

(a) Significantly different ($p=0.05$) from the laboratory control.

ATTACHMENT I

Data Sheets and Statistical Analyses
(12 pages)

FIELD CHAIN OF CUSTODY



Client : DNEEC-SIRB
 Address : 391 Lukens Drive
New Castle, DE 19720
 Phone No.: 302-395-2600

Report To : Robert Schulte
 Invoice To : Robert Schulte
 Account : _____
 ELS Batch # : _____

PROJECT NAME							No. Or Containers	ANALYSES						REMARKS	
SAMPLERS (Please Print)								Leptochirus Ex.	Benthic Macroinvertebrates						
(ELS Use Only) Lab Log No.	Client Sample Description	Sample Date	Sample Time	Matrix	Comp	Grab									
<u>Atmos I. Delaware River Oil Spill-NEDA</u>															
<u>Kristen Thornton</u>															
<u>ATY-799</u>	<u>DR SED03 121504</u>	<u>121504</u>	<u>1130</u>	<u>SP</u>		<u>X</u>	<u>2</u>	<u>X</u>	<u>X</u>						
<u>ATY-800</u>	<u>DR SED01 121504</u>	<u>121504</u>	<u>1345</u>	<u>SP</u>		<u>X</u>	<u>2</u>	<u>X</u>	<u>X</u>						
<u>ATY-798</u>	<u>DR SED02 121504</u>	<u>121504</u>	<u>1530</u>	<u>SE</u>		<u>X</u>	<u>4</u>	<u>X</u>	<u>X</u>						
RELINQUISHED BY: (signature)		DATE	TIME	RECEIVED BY: (signature)								AI - air BI - biological DL - drum liquids DS - drum solids GW - ground water OI - oil PW - potable water SD - solid SE - sediment	SL - sludge SO - soil SW - surface water TI - Tissue WS - waste solid WI - wipe WW - waste water X - Other		
<u>Kristen Thornton</u>		<u>December 21, 2004</u>	<u>14:35</u>	<u>Robert Schulte</u>		<u>12/22/04 1600</u>									
COMMENTS: <u>Please call Kristen Thornton with any questions 302-395-2600</u>															
Potential Hazard Identification: Non-Hazard <input type="checkbox"/> Flammable <input checked="" type="checkbox"/> Toxic <input checked="" type="checkbox"/> Skin-irritant <input checked="" type="checkbox"/> Biohazard <input checked="" type="checkbox"/> Other <input type="checkbox"/> <u>10% Formalin Presentation</u>															
Sample Disposal: Return to Client <input type="checkbox"/> Disposal by ELS <input type="checkbox"/> Authorized by: _____															

ELS USE ONLY

Sample Condition (circle response):

1. Shipped, Hand-delivered or Picked up by ELS: Yes No
 2. Received broken/leaking: Yes No
 3. Cooler Temperature Bottle: Yes No
 4. Properly preserved: Yes No
 5. Holding times expired: Yes No
 6. Bottles supplied by ELS: Yes No
 7. Field Filtered: Yes No

8. Custody Seal was Present/Unbroken: Yes No
 9. Discrepancies between sample labels and COC record?: Yes No
 10. Any Exceptions (see Comments): Yes No



SEDIMENT TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70005.08

Client: DNREC

QC Test Number: TN-05-013

TEST ORGANISM INFORMATION

Common Name: Amphipod Adults Isolated (Time, Date): _____
 Scientific Name: L. plumulosus Neonates Pulled (Time, Date): _____
 Lot Number: ~~LPS-001~~ LP-026 ^{with} 4/22/05 Acclimation: _____ Age: 3-5 mm
 Source: ABS Culture Water (T/S): 19.2 °C S ppt

TEST INITIATION

Date	Time	Initials	Activity
1/10/05	1130	CES/PG	Sediment Added to Chambers
↓	1650	PG	Overlying Water Added to Chambers
1/11/05	1015	PG	Organisms Transferred

TEST SET-UP

Sample Number(s): AT4-798, 799, 800, ^{PG 1/10} 305 ^{ATS-021} ~~025~~ _{with 2/24/05}

Overlying Water Number: 5 ppt PF

Treatment	Volume Test Sediment	Volume Overlying Water
Control	200ml	700ml
AT4-798	↓	↓
AT4-799		
AT4-800		

* Take NH₃ sample at Day 0 before renewal/loading and at Day 10. *



SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70005.08

TEST ORGANISM

Beginning Date: 1/11/05 Time: 1015

Client: DNREC

Common Name: Amphipod

Ending Date: 1/21/05 Time: 1115

QC Test Number: TN-05-013

Scientific Name: L. plumulosus

Test Material(s): Sediment

AT5-021 with 2/24/05

Accession Number(s): AT4-798, 799, 800, 395 TEST TYPE: Static / Flowthrough

Test Container: 1L beaker

Overlying Water: 5ppt PF

Renewal / Non-renewal

Test Volume: 200ml Sed. / 700ml Hzc

Accession Number: _____

Test Duration: 10day

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date <u>1/11/05</u>	Day 10 Date <u>1/21</u>	Day Date								
<u>Control</u>	<u>A</u>	<u>20</u>	<u>18</u>									
<u>AT5-021</u>	<u>B</u>	<u>20</u>	<u>19</u>									
	<u>C</u>	<u>20</u>	<u>19</u>									
	<u>D</u>	<u>20</u>	<u>19</u>									
	<u>E</u>	<u>20</u>	<u>18</u>									
<u>AT4-798</u>	<u>A</u>	<u>20</u>	<u>19</u>									
	<u>B</u>	<u>20</u>	<u>18</u>									
	<u>C</u>	<u>20</u>	<u>19</u>									
	<u>D</u>	<u>20</u>	<u>19</u>									
	<u>E</u>	<u>20</u>	<u>20</u>									
Time / Initials		<u>1015 pb</u>	<u>1115 pb</u>									



SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70005.08

TEST ORGANISM

Beginning Date: 1/11/05 Time: 1015

Client: DNREC

Common Name: Amphipod

Ending Date: 1/21/05 Time: 1115

QC Test Number: TN-05-013

Scientific Name: L. plumulosus

Test Material(s): Sediment

ATSAT5-04 ^{W/L} 1/11/05

Accession Number(s): AT4-798, 799, 800 TEST TYPE: Static / Flowthrough

Test Container: 1 L beaker

Overlying Water: 5ppt FF

Renewal Non-renewal

Test Volume: 200ml^{seal.} / 700ml H₂O

Accession Number: _____

Test Duration: 10 day

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date <u>1/11</u>	Day 10 Date <u>—</u>	Day Date								
AT4-799	A	20	7									
	B	20	7 ⁹⁷ ₁₋₂₁₋₀₅									
	C	20	4									
	D	20	8									
	E	20	6									
AT4-800	A	20	19									
	B	20	19									
	C	20	18									
	D	20	17									
	E	20	18									
Time / Initials		<u>1015 PLB</u>	<u>1115</u> <u>978 RSH</u>									



TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70005-08
 Client: DNREC
 QC Test Number: TN-05-013

TEST ORGANISM
 Common Name: Amphipod
 Scientific Name: L. plumulosus

Beginning Date: 1/11/05 Time: 1015
 Ending Date: 1/21/05 Time: 1115

TARGET VALUES Temp: 20 °C pH: 6.0 - 9.0 DO: 240% mg/L Salinity: 25 ppt

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		A		B		C			A		B		C			A		B		C			A		B		C		
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Control		19.9	20.0	20.4	20.1	19.0	19.4	19.0	6.8	6.7	7.4	6.7	6.8	7.1	7.2	3.9	4.4	7.2	7.8	8.5	8.0	7.9	4.7	5.0	4.4	4.3	4.5	4.5	4.9
AT4-798		19.8	20.6	20.7	20.0	19.0	19.6	19.2	6.8	6.8	7.6	7.0	7.0	7.2	7.3	4.4	4.5	7.7	8.0	8.2	8.0	8.4	4.7	4.7	4.7	4.6	4.6	4.5	4.5
AT4-799		19.5	20.5	20.3	19.5	19.3	19.3	19.1	6.7	6.7	7.4	7.1	6.9	7.2	7.2	3.9	3.2	7.5	8.0	8.0	8.2	8.2	4.7	4.6	4.5	4.6	4.4	4.5	4.4
AT4-800		19.2	20.3	19.8	19.6	19.5	19.2	19.0	6.8	6.7	7.6	7.2	7.0	7.2	7.2	4.1	3.6	7.7	7.7	8.6	7.9	8.2	4.7	4.6	4.7	4.6	4.3	4.5	4.1
Meter Number		342	342	342	342	342	342	342	342	342	342	342	342	342	342	341	341	341	341	341	341	341	342	342	342	342	342	342	342
Time		830	820	920	925	905	830	825	830	820	920	925	905	830	825	830	820	920	925	905	830	825	830	820	920	925	905	830	825
Initials		CES	CES	MK	MK	CES	CES	MK	CES	CES	MK	MK	CES	CES	MK	CES	CES	MK	MK	CES	CES	MK	CES	CES	MK	MK	CES	CES	MK



TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70005.03

TEST ORGANISM

Beginning Date: 7/11/05 Time: 1015

Client: DNREC

Common Name: Amphipod

Ending Date: 7/21/05 Time: 1115

QC Test Number: TN-05-013

Scientific Name: L. plumulosus

TARGET VALUES Temp: 20 ± 1 °C

pH: 6.0 - 9.0

DO: 240% mg/L

Salinity: 5 ppt

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14
Control		19.1	20.9	20.3					7.2	7.0	7.0					8.3	7.8	7.5					4.3	4.5	4.3				
AT4-798		19.1	20.9	20.3					7.2	7.1	7.1					8.4	8.0	8.1					4.6	4.7	4.6				
AT4-799		19.0	19.5	20.5					7.2	7.0	6.8					8.5	7.9	7.4					4.4	4.8	4.4				
AT4-800		19.1	21.0	19.3					7.2	7.0	6.8					8.3	7.6	6.3					4.5	4.4	4.8				
Meter Number		312	312	312					312	312	312					311	311	311					312	312	312				
Time		1015	845	0742					1015	845	0742					1015	845	0738					1015	845	0742				
Initials		MK	CES	MS MK					MK	CES	MS MK					MK	CES	MS					MK	CES	MS MK				

MK



TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70005.08

TEST ORGANISM

Beginning Date: 7/11/05 Time: 1015

Client: DNREC

Common Name: Amphipod

Ending Date: 7/21/05 Time: 1115

QC Test Number: TN-05-013

Scientific Name: L. plumulosus

TARGET VALUES Temp: 20 °C

pH: 6.0 - 9.0

DO: ≥40% mg/L

Salinity: 5 ppt

Test Conc	Rep	Temperature (°C)								pH								Dissolved Oxygen (mg/L)								Conductivity (µS/cm) / Salinity (ppt)							
		0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6				
Control		19.0							7.3							5.0								4.9									
AT4-798		19.0							7.4							6.1								4.9									
AT4-799		19.1							7.2							6.0								5.0									
AT4-800		19.1							7.3							6.1								5.0									
Meter Number		340							100							341								340									
Time		950							950							945								950									
Initials		PL							PL							PL								PL									



TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005.08

Client: DNREC

QC Test Number: TN-05-013

Date/Time/Initials

Comments/Activity

1/10/05 1115 PG/LES

All ^{test} samples had a lot of dead clams in the sample.
Sample AT4-799 had a very strong oil-like smell.
(petroleum)

1/11/05 800 PG/LES

NH₃ samples taken and all beakers renewed.

1/13/05 1340 PG

Dissolved oxygen fell below 40%. Beakers were aerated lightly, approx 1 bubble/5sec.
The AT4-799 replicates had fewer burrow holes compared to other samples. Replicate 799E had a shiny, iridescent film ~~that~~ ^{PG} present on the surface of the water.

1/21/05 1200 NH4

Sample AT4-799 had petroleum smell and obvious mortality of test organisms. There were little ^{bits} oil balls recovered in the sieve. An oily sheen was observed spreading around the clumps. V2

Leptocheirus plumulosus 10-Day Test

Start Date: 1/11/2005	Test ID: TN-05-013	Sample ID: DNREC
End Date: 1/21/2005	Lab ID:	Sample Type: Sediments
Sample Date:	Protocol: EPAA 91-EPA Acute	Test Species: LP-Leptocheirus plumulosus
Comments:		

Conc-%	1	2	3	4	5
Control	0.9000	0.9500	0.9500	0.9500	0.9000
Sed 01	0.9500	0.9500	0.9000	0.8500	0.9000
Sed 02	0.9500	0.9000	0.9500	0.9500	1.0000
Sed 03	0.3500	0.3500	0.2000	0.4000	0.3000

Conc-%	Transform: Arcsin Square Root							1-Tailed		
	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	0.9300	1.0000	1.3068	1.2490	1.3453	4.034	5			
Sed 01	0.9100	0.9785	1.2724	1.1731	1.3453	5.772	5	0.852	1.860	0.0752
Sed 02	0.9500	1.0215	1.3487	1.2490	1.4588	5.509	5			
Sed 03	0.3200	0.3441	0.5988	0.4636	0.6847	14.062	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.90981	0.781	-0.2799	-1.3111		
F-Test indicates equal variances (p = 0.54)	1.94133	23.1539				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.04261	0.04572	0.00296	0.00409	0.41909	1, 8

ATTACHMENT II

Report Quality Assurance Record
(2 pages)



REPORT QUALITY ASSURANCE RECORD

Client: Delaware DNREC Project Number: 70005.08
 Author: W McFulloch EA Report Number: 4691

REPORT CHECKLIST

<u>QA/QC ITEM</u>	<u>REVIEWER</u>	<u>DATE</u>
1. Samples collected, transported, and received according to study plan requirements.	<u>W McFulloch</u>	<u>2/22/05</u>
2. Samples prepared and processed according to study plan requirements.	<u>W McFulloch</u>	<u>2/22/05</u>
3. Data collected using calibrated instruments and equipment.	<u>W McFulloch</u>	<u>2/22/05</u>
4. Calculations checked:		
- Hand calculations checked	<u>W McFulloch</u>	<u>2/22/05</u>
- Documented and verified statistical procedure used.	<u>W McFulloch</u>	<u>2/22/05</u>
5. Data input/statistical analyses complete and correct.	<u>Richard A. Connolly</u>	<u>3/1/05</u>
6. Reported results and facts checked against original sources.	<u>Richard A. Connolly</u>	<u>3/1/05</u>
7. Data presented in figures and tables correct and in agreement with text.	<u>Richard A. Connolly</u>	<u>3/1/05</u>
8. Results reviewed for compliance with study plan requirements.	<u>W McFulloch</u>	<u>2/22/05</u>

	<u>AUTHOR</u>	<u>DATE</u>
9. Commentary reviewed and resolved.	<u>W McFulloch</u>	<u>3/4/05</u>
10. All study plan and quality assurance/control requirements have been met and the report is approved:		
	<u>W McFulloch</u> PROJECT MANAGER	<u>3/4/05</u> DATE
	<u>Richard A. Connolly</u> QUALITY CONTROL OFFICER	<u>3/1/05</u> DATE
	<u>Virginia A. Sohn</u> SENIOR TECHNICAL REVIEWER	<u>3/4/05</u> DATE